



## Electromagnetic Fields and Fertility Hazards: Incoherent Pieces of a Story

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### Editor in Chief

Since many electronic devices have been surrounded contemporary life especially in urban societies, every person is inevitably exposed to the radiations of electromagnetic fields (EMF). These increasing radiation emitted from the home appliances, mobile phone, medical diagnostics technologies with wide frequency range (1-4) classifying into extremely low frequency fields (ELF, 1 Hz-100 Hz), high frequency fields in the radio frequency band (100 kHz-3 GHz), and microwaves (> 3 GHz) (5).

Alongside increasing and pervasive EMF, concerns have been more serious in potentially adverse effects, which might be threatening to human health. However, though contradictory results in the genotoxic potential of ELF-EMF, the International Agency for Research on Cancer has considered it "possibly carcinogenic" (5-7).

Fertility is thought as one of biologic function can be threatened through electromagnetic radiation, especially in men. Testes as surface organ could be more exposed by the radiation emitted from the appliances containing EMF such as cell phone (8). Thermal effects are suspected as main guilty part of EMR in fertility concerns. However, meta-analysis performed by Adams et al. have been concluded radiofrequency (RF) electromagnetic radiation affects semen and sperm quality adversely through thermal or non-thermal mechanisms (9). Since mobile phones are often carried in back pocket or waist pockets where located in reproductive organs vicinity, emitted EMR can induce thermal effects on the area leading to the spermatogenesis suppression and sperm motility/viability fall (9,10), sperm motility and viability.

One of the first studies of human and mobile phone RF interaction 52 males ages between 18 and 35 were investigated (11,12). This study revealed that males speaking with a mobile phone over hours

daily had scant sperm, lower viability, and motility. Interestingly, all parameters fluctuation could be affected on the basis of exposing duration (11,13-15).

In the term of ELF-EMF harmfulness etiology, it is not attributed to the tissue heating and DNA break because not being contained enough energy to induce thermal effects and destruct DNA directly resulting in genotoxic effects. Hence, it is thought that oxygen radicals generation and scavenger mechanisms insufficiency lead to DNA defragmentation and germ cell apoptosis (5,16,17). These effects differ in severity on the basis of EMF intensity, expose duration and recovery quality (5). Duan et al. study showed that ELF can influence sperm parameters and male/female fertilizing ability in rats. Same magnetic field decreased boar sperm fertility and increased abnormal morphology (18). In addition Panagopoulos et al. ELF (50-60 Hz) reduced adult drosophila fertility to 4.3% (19).

To verify the correlation between male infertility and mobile phone use, many epidemiological studies, animal and in vitro investigations have been carried out. Twelve studies included in Liu et al. meta-analysis; human cross-sectional analysis revealed that mobile phone EMR has adverse effects on the sperm parameters, in vitro and animal studies also showed a similar effect. This meta-analysis including English and Chinese language studies emphasize that methodology difference is why controversial results (20).

Almasiova et al. studied histopathology consequences of EMR 2.45 GHz expose in rat testes tissue. They reported degenerative changes displaying sertoli cell necrosis and other necrotic appearances within organelles and nuclei (1). In another study, Azadi et al. showed that EMR 950 MHz with 2 weeks duration and 2 h/day emission either decrease epididymis diameters or so increase

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epididymal epithelium cells apoptosis. In the continue sperm surface protein disruption leads to the impaired maturation (4). Also, Mugunthan et al. exposed chronically mice with second and third generation (2G: 900-1800 MHz, 3G: 1900-2200 MHz) cell phone electromagnetic radiation. This emission affects mean number of Leydig cell and testes weight, sertoly and spermatogonia cell attachment and basal lamina integration adversely (8).

In conclusion, the majority of literature explaining EMR and male reproduction crosstalk remain controversial with indecisive results. These data are considered important in subfertile men exposed to high loaded environmental electromagnetic radiation. Moreover, today, mankind is surrounded with magnetic waves to facilitate his life. We are unable to imagine turning off our Wi-Fi, cellphone, computers and/or other similar appliances even for a second. However, local or global alliances constructed from inventors, manufacturers, accreditation organs, and health experts must make a serious commitment to revising safety protocols concurrent with the rapid technological progress.

#### Ethical issues

Ethical of this research work was approved by Bioethics Committee of Avicenna Research Institute, Tehran, Iran.

#### Conflict of interests

We declare that we have no conflict of interests.

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#### References

- Almasiova V, Holovska K, Cigankova V, Racekova E, Fabianova K, Martoncikova M. Structural and ultrastructural study of rat testes influenced by electromagnetic radiation. *J Toxicol Environ Health A* 2014; 77: 747-50.
- Marjanovic AM, Pavicic I, Trosic I. Biological indicators in response to radiofrequency/microwave exposure. *Arh Hig Rada Toksikol* 2012; 63: 407-16.
- Kesari KK, Kumar S, Behari J. Mobile phone usage and male infertility in Wistar rats. *Indian J Exp Biol* 2010; 48: 987-92.
- Azadi OE, Rajaei F, Safari VA, Sarokhani MR, Javadi A. Effects of microwaves (950 MHz mobile phone) on morphometric and apoptotic changes of rabbit epididymis. *Andrologia* 2014.
- Lee SK, Park S, Gimm YM, Kim YW. Extremely low frequency magnetic fields induce spermatogenic germ cell apoptosis: possible mechanism. *Biomed Res Int* 2014; 2014: 567183.
- Ruiz-Gomez MJ, Martinez-Morillo M. Electromagnetic fields and the induction of DNA strand breaks. *Electromagn Biol Med* 2009; 28: 201-14.
- Non-ionizing radiation, Part 1: static and extremely low-frequency (ELF) electric and magnetic fields. *IARC Monogr Eval Carcinog Risks Hum* 2002; 80: 1-395.
- Mugunthan N, Anbalagan J, Shanmuga Samy A, Rajanarayanan S, Meenachi S. Effects of chronic exposure to 2g and 3g cell phone radiation on mice testis-a randomized controlled trial. *Int J Cur Res Rev* 2015; 7: 36-47.
- Adams JA, Galloway TS, Mondal D, Esteves SC, Mathews F. Effect of mobile telephones on sperm quality: a systematic review and meta-analysis. *Environ Int* 2014; 70: 106-12.
- Agarwal A, Singh A, Hamada A, Kesari K. Cell phones and male infertility: a review of recent innovations in technology and consequences. *Int Braz J Urol* 2011; 37: 432-54.
- Çoruh D, Duman S, Paylan A, Aktan TM. The effect of mobile phone on the motility and DNA integrity of human sperm. *Selçuk Týp Derg* 2014; 30: 165-8.
- Kilgallon SJ, Simmons LW. Image content influences men's semen quality. *Biol Lett* 2005; 1: 253-5.
- Agarwal A, Deepinder F, Sharma RK, Ranga G, Li J. Effect of cell phone usage on semen analysis in men attending infertility clinic: an observational study. *Fertil Steril* 2008; 89: 124-8.
- Fejes I, Zavaczki Z, Szollosi J, Koloszar S, Daru J, Kovacs L, et al. Is there a relationship between cell phone use and semen quality? *Arch Androl* 2005; 51: 385-93.
- Wdowiak A, Wdowiak L, Wiktor H. Evaluation of the effect of using mobile phones on male fertility. *Ann Agric Environ Med* 2007; 14: 169-72.
- Challis LJ. Mechanisms for interaction between RF fields and biological tissue. *Bioelectromagnetics* 2005; Suppl 7: S98-S106.
- La VS, Condorelli RA, Vicari E, D'Agata R, Calogero AE. Effects of the exposure to mobile phones on male reproduction: a review of the literature. *J Androl* 2012; 33: 350-6.
- Duan W, Liu C, Wu H, Chen C, Zhang T, Gao P, et al. Effects of exposure to extremely low frequency magnetic fields on spermatogenesis in adult rats. *Bioelectromagnetics* 2014; 35: 58-69.
- Panagopoulos DJ, Karabarbounis A, Lioliouis C. ELF alternating magnetic field decreases reproduction by DNA damage induction. *Cell Biochem Biophys* 2013; 67: 703-16.
- Liu K, Li Y, Zhang G, Liu J, Cao J, Ao L, et al. Association between mobile phone use and semen quality: a systemic review and meta-analysis. *Andrology* 2014; 2: 491-501.

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